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NEW HAMPSHIRE AGRICULTURAL
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STUDIES IN ECONOMICS OF APPLE ORCHARDING

Part II. A Study of Farm Organization on 12 Fruit Farms

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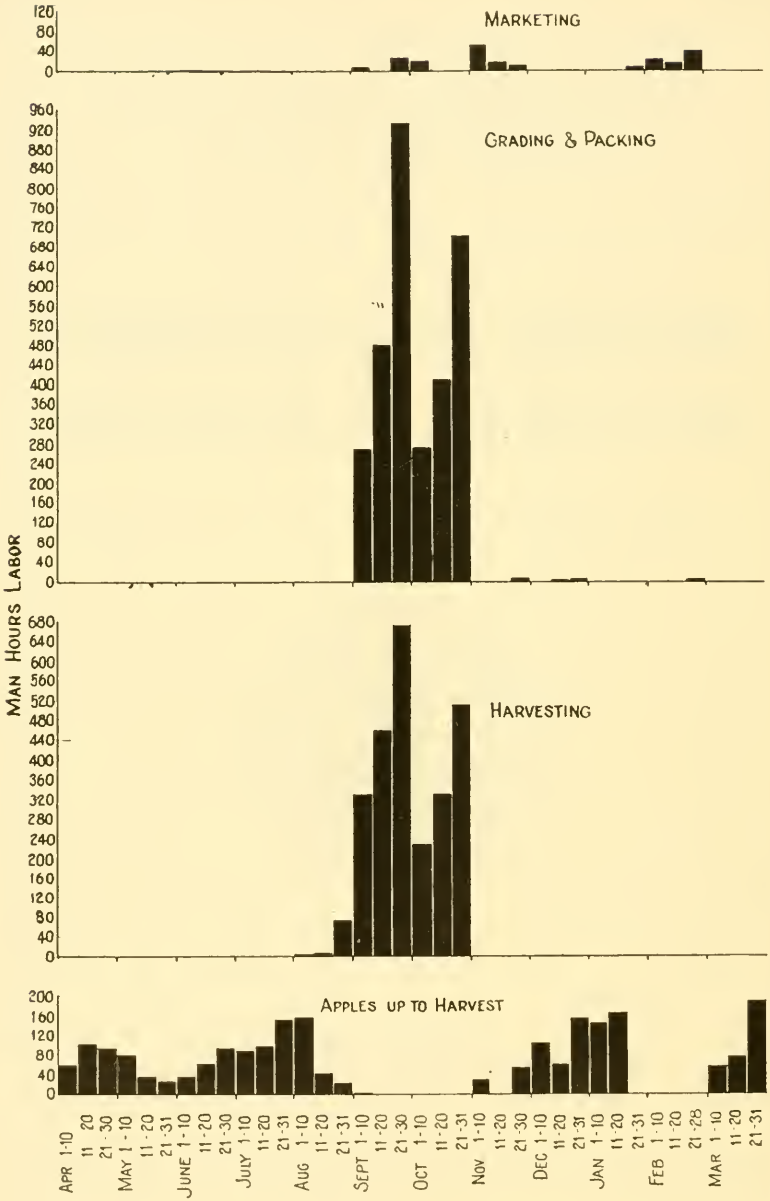

FIG. 1. *Distribution of man hours by 10-day periods on Farm 7 on apples (1) prior to harvest; (2) harvesting; (3) grading and packing; and (4) marketing. Apples were graded and packed simultaneously with harvesting.*

STUDIES IN ECONOMICS OF APPLE ORCHARDING

By H. C. WOODWORTH and G. F. POTTER

In a previous publication* the writers have presented findings on management, methods and costs of producing apples from the viewpoint of an orchard enterprise study. This type of study can bring out rough comparisons of costs of different practices and is especially valuable in studying methods of producing one crop. However, many of the costs considered, whether in terms of hours of labor or of money, are not additional out-of-pocket expenses. If, for instance, a certain orchard farm organization requires a permanent crew of two men, the expenses concerned with these two men occur whether their time is employed advantageously or not. Hours used at peak demands and at slack periods have not the same value.

Obviously, certain problems of orchard management must be studied from the viewpoint of farm organization. It is from this angle that an analysis of problems based on the data from the same 12 farms as in the previous study is now attempted.

On a few farms the only product of any consequence was apples. Here all the costs may be considered as entering into apple production. On one such farm the average cash outlay for a three-year period (not including wages of management or interest on the investment) was $1.51 per box. During this period the estimated loss in inventory of trees, equipment and consumable supplies was about 24 cents per box, bringing the operating costs to $1.75 per box. The average selling price of the apples was $1.99, leaving 24 cents per box for wages of management† and interest on the investment. In this case wages paid to regular help during periods when there was little or no orchard work to do created a considerable overhead.

The majority of the farms were diversified, and it is impossible to determine what share of the overhead expenses is chargeable to apples. A general financial statement covering all enterprises is, therefore, given herewith. Because individual records are confidential, the statements for the several farms are grouped together.

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* Woodworth, H. C. and Potter, G. F.—New Hampshire Bulletin 267.

† Wages of management" is used here in a technical sense to indicate returns on managing ability. All physical labor has been included in labor cost at the rates actually paid. Since hired help did all the physical and routine work on this farm, it was possible to determine the actual labor cost of operating the farm. However, the proprietor of this orchard had brought together the factors of production and planned the project to obtain something more than merely interest on money and return on hired labor. "Wages of management" is used here to express this return which the operator has expected for services of initiating the orchard project and in guiding the use of production factors.

The Financial Situation—Investment and Income

Capital Investment

In figuring the investment on individual farms, the buildings and land (without the trees) were estimated at approximately what the farm would bring on the market for purposes other than for fruit. These estimates ranged from $1,000 to $10,000. (Table 1). There were 10 farms included in the study in 1926, 12 in 1927, and nine in 1928. The average investment for all three years was $5,464.

The out-buildings, with one exception, were such as one would find on dairy farms of the state.

The value of trees was estimated on a basis to be explained in detail in a future publication. In brief, this value is based in part on costs of growing trees and in part on expected future returns discounted back to date. The cost of growing trees was given greater consideration in the earlier years, and expected returns greater weight in the later years. On this basis the highest value is reached at about 19 or 20 years of age. This is just at the beginning of the period of largest net operating profits.

The total investment including equipment and other personal property averaged $19,792 for all farms. The trees and the farm constitute about 82 per cent of this amount.

Expenses

The average cash expense, not including payment on interest or principal, for all farms in the study is shown in Table 2. Hired labor was the largest single item, from 34 to 43 per cent during the three years. On the seven farms which were in the study for the entire period, the expenses average $5,575, $7,715, and $7,324, respectively, for the different years.

Consumable supplies, which include spray material, fertilizer, apple boxes, apple wrappers, etc., averaged $1,392 for the three years.

No unpaid family labor was included in the labor costs. On several large farms, labor by members of the family in packing apples was actually paid for by check at the regular rate of pay.

Receipts

In 1926, a year of generally low apple prices, the total average receipts were $5,421. (Table 3). Of this 65 per cent was from sale of apples, 10 per cent from small fruits, 5 per cent from truck crops. In 1927, with a favorable combination of good yields and high prices, the average receipts on 12 farms were $9,315, of which apples were 73 per cent. In 1928, the total receipts averaged $8,316, of which apple sales were 66 per cent. For all farms for three years, the average receipts were $7,735 per farm, of which 70 per cent were from sale of apples.

Apples from the different orchards were sold at various stages in the marketing process; hence the prices received are not comparable. To determine the relative price on the tree for each year, the apples were traced backward to the pre-harvest stage by allowing for estimated costs of the different services rendered. (See Table 4).

Estimated in this way, the net returns were $.49 per box on tree in 1926, $1.14 in 1927 and .76 in 1928. The weighted average return for three years was $.83 per box. While these are necessarily rough estimates, they are put in at this time because the price of apples is con-

TABLE 1—*Average capital investment and inventory gain or loss on 12 fruit farms, 1926-28*

	1926 10 FARMS		1927 12 FARMS		1928 9 FARMS		ANNUAL AVERAGE PER FARM	
	Capital investment	Gain or loss of inventory	Capital investment	Gain or loss of inventory	Capital investment	Gain or loss of inventory	Capital investment	Gain or loss of inventory
	DOLLARS	DOLLARS	DOLLARS	DOLLARS	DOLLARS	DOLLARS	DOLLARS	DOLLARS
Equipment	1,929	— 116.58	1,803	— 43	2,347	— 155	2,002	— 99
Consumable supplies	721	— 358.92	307	— 156	202	+ 132	410	— 138
Livestock	474	— 31.75	486	+ 3	652	+ 71	530	+ 12
Crops and seed	111	+ 35.70	127	— 66	82	+ 13	109	— 10
Personal property	$3,235	—$472.	$2,723	—$261	$3,283	+ $61	$3,051	—$235
Land and buildings	$5,100	.....	$4,933	....	$6,578	+$111	$5,464	+ $32
Trees	10,289	+$376	10,133	+$293	13,901	+ 93	11,277	+ 262
Total real estate	$15,389	+$376	$15,066	+$293	$20,479	+$204	$16,741	+$294
Total investment	$18,624	— $95	$17,789	+ $32	$23,762	+$265	$19,792	+ $59

Table 2—*Average expenses on fruit farms, 1926-28*

Expense Items Classified	1926 10 Farms	1927 12 Farms	1928 9 Farms	Annual Average per Farm
	dollars	dollars	dollars	dollars
Real estate	110.73	189.29	200.95	167.33
Equipment	185.73	400.73	476.88	353.48
Labor	1,627.12	1,962.14	2,885.46	2,122.13
Livestock	51.39	135.35	84.90	93.62
Poultry	92.56	233.81	43.50	133.00
Feed	231.58	388.90	584.07	394.82
Trees and other expense	51.28	44.86	14.21	38.04
Small fruits	70.34	53.26	35.34	53.56
Spray materials	186.86	241.06	484.10	294.13
Fertilizer and lime	358.85	358.73	457.06	387.31
Other consumable supplies	745.81	747.97	623.20	711.05
Seeds	29.90	90.96	95.00	72.44
Bees	3.26	3.26	10.78	5.44
Products bought for resale	89.53	448.18	154.09	247.11
General expenses	470.10	500.79	559.20	507.85
Miscellaneous	4.45	25.20	.....	11.19
Trucking apples	4.95	18.67	12.84	12.55
Total	$4,314.44	$5,843.18	$6,721.58	$5,605.06

Table 3—*Average receipts on fruit farms, 1926-28*

Receipts Classified	1926 10 Farms	1927 12 Farms	1928 9 Farms	Annual Average per Farm
	dollars	dollars	dollars	dollars
Apples	3,750.34	6,815.90	5,525.34	5,452.33
Other fruits	35.88	64.58	120.09	71.44
Small fruits	524.04	391.54	524.93	473.01
Truck crops	246.91	358.97	199.38	276.49
Hay	51.62	94.92	62.39	71.51
Lumber and wood	129.41	183.42	88.42	138.43
Nursery stock	12.53	12.50	.....	8.88
Potatoes	138.09	107.05	36.07	96.46
Sweet corn	21.22	41.02	37.69	33.67
Poultry and products	105.03	573.33	631.06	439.02
Dairy receipts	161.37	6.64	243.53	487.35
Livestock sold	9.45	83.75	31.12	44.50
Consumable supplies sold	67.43	72.08	187.34	104.04
Outside labor	58.98	121.51	101.39	95.50
Game damage compensation	75.80	.....	.....	24.45
Miscellaneous	31.38	12.21	16.60	19.67
Purchased products sold*	.....	375.12	177.20	196.65
Equipment	1.30	.....	.....	.42
Grading outside apples	.....	.....	333.33	96.78
Seed oats	.....	.....	.30	.09
Total	$5,420.82	$9,478.13	$8,325.07	$7,734.56

* Receipts for products resold were in some cases included with sales of products from the farm.

fusing to many people insofar as it relates to the grower's return on the tree.

Thus, a certain lot of fancy apples of the 1928 crop finally sold for $3.03 per box. The selling expense, storage, commission, transportation, was $.717 per box. The packing house charges for grading, packing, containers, etc., were $.65¼ per box. These two items taken from the price leave approximately $1.66 per box on basis of delivery at the packing plant. An estimate of $.20 for harvesting and hauling to plant would leave approximately $1.46 on the tree.

In the receipts per farm for apples as given in Table 4, returns in the majority of cases included the box and packing charges, but not the transportation, storage and commission. In two instances the cost of packing is not included because the fruit was sold either through a co-operative association, which furnished these materials and services and made a return for the ungraded fruit at the door of the packing plant, or it was sold in one grade and without the package. In three cases the growers provided their own storage.

TABLE 4—*Total gross returns, total estimated costs of harvesting and marketing, and estimated returns per bushel on tree by years. Expense of grading and packing a portion of the crop is estimated from labor records. On some farms apples were not graded or packed.*

	1926 10 FARMS	1927 12 FARMS	1928 9 FARMS	3 YEARS 31 FARMS
Bushels harvested	33,744	45,071	37,181	115,996
Per cent of "normal expected yield"*	111%	117%	102%	110%
Gross returns in dollars	$37,503	$75,197	$49,728	$162,428
No. boxes packed	20,613	24,758	19,977	65,348
No. barrels packed	1,000	1,000	1,500	3,500
Harvesting costs in dollars	$5,034	$6,761	$5,577	$17,372
Cost of packing estimated	$13,018	$15,605	$13,111	$41,734
Trucking and storage	$1,800	$600	$1,700	$4,100
Selling retail estimated	$1,000	$1,000	$1,000	$3,000
Total cost	$20,952	$23,966	$21,388	$66,306
Net return for apples on tree	$16,551	$51,231	$28,340	$96,122
Net return per bushel	$ .49	$ 1.14	$ .76	$ .83

* See New Hampshire Expt. Sta. Bull. 257, p. 8.

If we consider the seven farms which were in the study continuously for three years, the receipts from apples in 1926, 1927, and 1928, were $4,843, $8,737, and $6,474, respectively. This rather wide deviation is somewhat typical of the specialized apple business. The management problem, after a poor income year is rather serious. There is a tendency to hold down the operations in the following year. This is in the main good practice providing the economy does not proceed to the point of withholding essential fertilizer or spray material. A study of the income from apples on individual farms shows considerable variation per box due to method of selling. The time of selling was a factor in 1928.

In the three years a total of $73,849 was taken in for sales other than apples by the farms under study. This amounts to $2,282 per farm per year. Three sales items—small fruit, poultry, and milk—each averaged over $400 per farm.

Income

The farm income was computed for each farm by subtracting cash expenses plus loss in inventory from cash receipts plus inventory gains (Table 5.) The resulting figure is the return for wages of labor and management of the operator and returns on the capital invested. In the three years the average farm income was $1,011, $3,667, and $1,867, respectively. These are the average incomes that the operators would enjoy if their farms and personal property were free of debt.

Table 5—*Financial statement of average receipts and expenses and labor income on orchard farms for three years*

	1926 10 Farms	1927 12 Farms	1928 9 Farms	Annual Average per Farm
	dollars	dollars	dollars	dollars
Total cash receipts	5,421	9,478	8,325	7,835
Gain in inventory	.....	32	266	50
Total receipts	$5,421	$9,510	$8,591	$7,885
Total cash expense	$4,315	$5,843	$6,722	$5,605
Loss in inventory	95	.....	.....	.....
Total expense	$4,410	$5,843	$6,722	$5,605
Farm income	$1,011	$3,667	$1,869	$2,279
Interest on investment	931	890	1,026	943
Labor income	80	2,777	843	1,346

By assuming that 5 per cent on the investment as estimated in inventory was the return for capital, an estimated labor income was computed for each farm. It is to be remembered that the inventory values were arbitrarily made up and that the value of trees, for instance, was based partly on expected returns. Actually, if we were able to make an historical study of the costs of the orchard we might find that the trees had cost twice this on some farms and perhaps less on others. Also, it is well to recall that the profitableness or unprofitableness of the apple business over a period of years has an influence on the sale value of orchards. The labor income as shown here should be conceived of as estimated and based on assumed interest on estimated value rather than real income.

As would be expected in a business with varying production as well as varying prices, the labor incomes fluctuated greatly, ranging from $80 in 1926 to $2,777 in 1927, a year of good yields and high apple prices. The average of the 31 annual incomes was $1,346.

The average labor income of the seven farms which were in the study for three years was –$14 in 1926, $2,833 in 1927 and $966 in 1928. Several farms with low incomes in 1926 had incomes of over $5,000 in 1927.

The distribution of individual farm incomes by years is shown in Table 6.

In 1926, the range in income was from –$1,936 to $2,112; in 1927, from –$847 to $5,979, and in 1928, from –$3,678 to $7,195. The average annual income for each farm for the period of the study ranged from $7 to $2,940 and the mean was $1,303.

TABLE 6—*Distribution of individual incomes by years. The identity of the individual farms is not shown. The incomes are arranged each year in order of size of income.*

	1926 10 FARMS	1927 12 FARMS	1928 9 FARMS	AVERAGE INDIVIDUAL INCOMES THREE YEARS
	DOLLARS	DOLLARS	DOLLARS	DOLLARS
	2,112	5,979	7,195	2,940
	1,073	5,636	2,060	2,889
	477	5,474	1,667	1,991
	415	4,154	1,291	1,884
	407	3,418	249	1,609
	356	2,556	69	1,352
	117	2,179	—423	1,057
	—999	1,675	—847	832
	—1,229	1,471	—3,678	509
	—1,936	971	.....	492
	.....	656	.....	72
	.....	—847	.....	7
Average	80	2,777	843	1,303*

* This is different from the average in Table 5, because some of the farms were in the study only 2 years.

DISTRIBUTION OF TIME ON APPLES

Harvesting

The amount and the distribution of time spent on the apple crop vary widely. The individual orchardist has the choice of selling apples tree-run at harvest time or of following through to any stage in the marketing process. For example, in the case of Farm 8, the grading, packing, and marketing were performed by a co-operative association. Even the hauling of the apples from the farm to the packing plant was done by a truck contractor employed by the association. In this case about 21 per cent of the total field time was spent on operations prior to harvest, and 76 per cent on harvesting. The yields were very high, and under these circumstances picking and hauling apples to the barn constituted about three-fourths of the year's work. Practically nothing but apples was produced.

On Farm 7 three grades of apples were packed in boxes. The apples of the two best grades were accurately sized, individually wrapped in oiled paper and placed in the box in definite arrangement. While there was storage available on this farm, all the apples were graded and packed as they came from the trees. Hence, at harvest time two crews were employed simultaneously, one to pick and haul, the other to grade and pack the apples. Since there were only two regular men, including the operator on this farm, most of the work of grading and packing would have to be short-time help whether apples were packed immediately and then stored, or stored and packed at odd times later. Thus, the labor costs in grading and packing were largely out-of-pocket expenses, and since this operator was attempting to supply a special demand for high quality fruit which could be sold at any time it was advantageous to grade and pack direct from the tree.

In relation to the size and number of trees, yields on Farm 7 were only about half those obtained on Farm 8. Had the yields been equivalent, an exceedingly high labor peak would have occurred at the harvest period. As a matter of fact, however, the problem is not so difficult as it would appear because women can be used for most of the packing house labor. In a packing plant putting up 300 to 500 boxes per day, one man is required to dump the apples on the grading machine, another to nail the packed boxes, perhaps a third for miscellaneous work. However, an expert nailer should be able to nail the 400 boxes and also tend to the odd jobs. Extra help to arrange boxes in the storage or to load trucks is needed also. The fruit is graded and placed in the boxes by women. The wrapping and packing is generally done on a piece-work basis. The wages earned are sufficient to attract local women who look forward to annual employment during the apple packing season and develop considerable skill in the work. On Farm 7 practically all of the work during the growing season was done by the operator with one regular man. At harvest the operator supervised the packing house, and the assistant took charge of the picking crew. All of the fruit from this farm was sold through wholesale channels so that no time was required after packing except to load the boxes on trucks or cars. The distribution of time for growing, harvesting, packing and shipping is shown in Figure 1. On this farm 26 per cent of the field time was spent in operations prior to harvest, 33 in harvesting, 37 in grading, packing and marketing, and 4 per cent in enterprises other than apple production.

On Farm 2 apples were graded and packed much as on Farm 7, although a smaller proportion was wrapped and a large proportion was marketed to retail stores. On this farm a large common storage is used to hold the fruit as picked, and the grading, packing and marketing are carried on through the winter, furnishing employment for the operator and his crew over a long period. In fact, apple packing was done to a considerable extent during stormy winter weather when the time could not be used advantageously on other crops. There is some extra handling involved and the total time put on apples is considerably increased, but normally there is not as high a labor peak at the picking period.

It is to be noted that on this farm there were six to seven regular men to provide with productive work. Figure 2 illustrates graphically how the packing and marketing functions served to supplement the field work and to provide employment over a long period. Farm 2 was considerably diversified, 33 per cent of the total field time being put on crops other than apples. Considering the apples only, 25 per cent of the time was spent in growing, 49 per cent in harvesting, and 26 per cent in marketing. The yields in this case were high.

On these three farms and some of the others, the apples were finally sold in a closely graded uniform pack. While consumers appreciate uniform high quality in apples, many prefer not to pay the extra costs involved. Hence on Farm 4, for example, the apples were of rather uniformly high quality and were sold practically tree-run. They were put into boxes furnished by the buyer without definite arrangement even of the face layer—in other words, in jumble pack. Apples below what is considered a B grade, i. e., culls and cider apples, were eliminated

while picking or by a simple grading process as the boxes were filled. This farm, like Farm 2, is considerably diversified, 40 per cent of the total field time being put on crops other than apples. Of the time spent on apples, 48 per cent is used in growing, 38 per cent in harvesting, and 14 in grading, filling boxes and loading trucks. In this case also yields were high. It is probably true, moreover, that the operator was especially meticulous in caring for the crop before harvest so that the fruit might be uniformly good, and might require the minimum of sorting and grading.

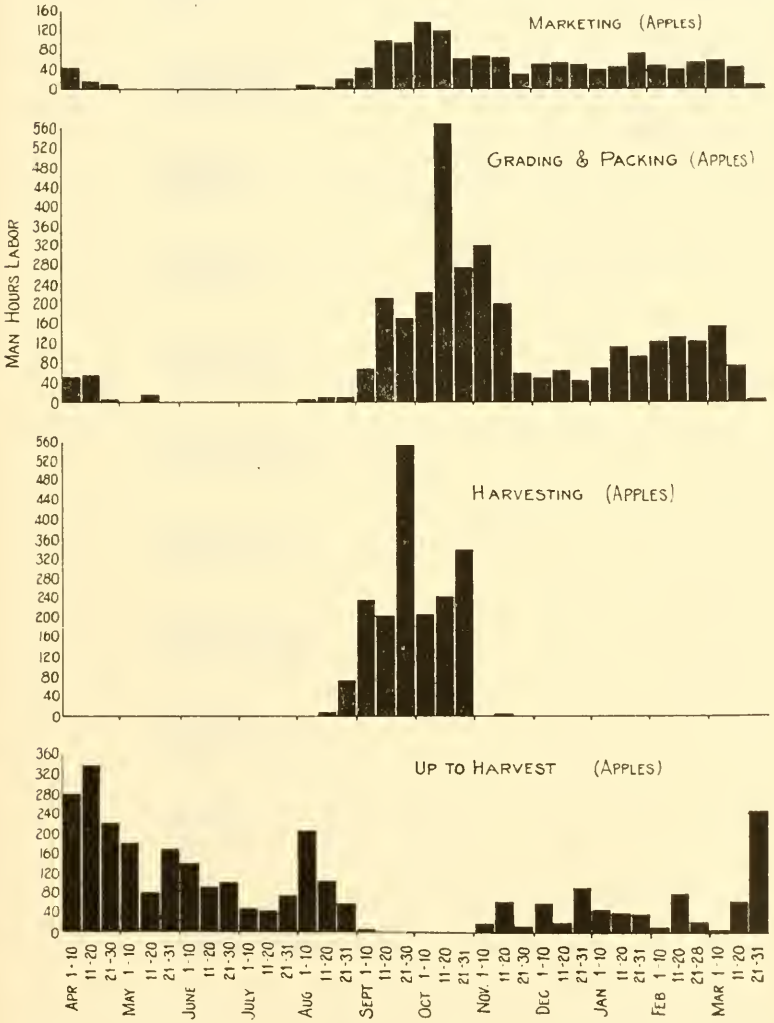

FIG. 2. *Distribution of man hours by 10-day periods on Farm 2 on apples (1) prior to harvest; (2) harvesting; (3) grading and packing; and (4) marketing. Some apples were graded and packed after harvest was completed.*

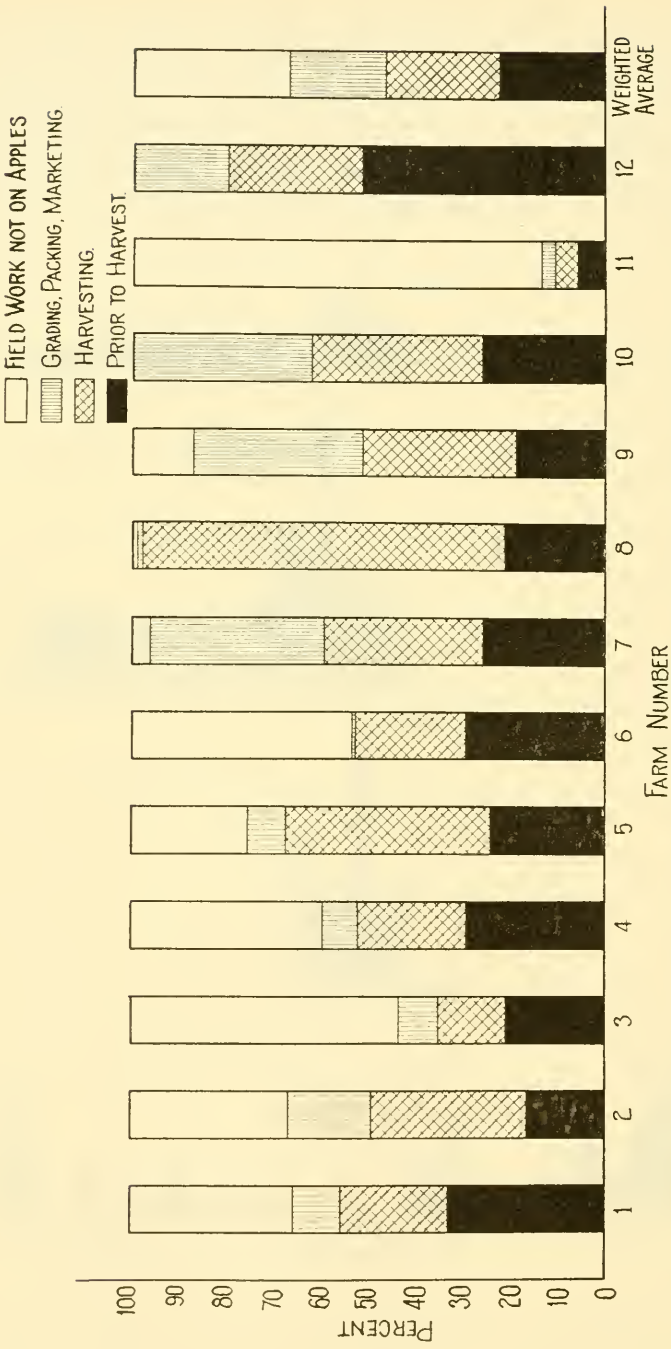

Fig. 3. *Percentage distribution of man labor on 12 farms on field labor divided as to hours (1) prior to harvest; (2) harvesting; (3) grading, packing and marketing, and (4) field work not on apples.*

On the smaller farms, where it was difficult for the operator to supervise both harvesting and packing, the usual practice was to use the whole crew in picking when harvest was most timely and then to grade and pack between variety harvests or whenever weather conditions were unfavorable.

The time spent on all field crops on the 12 farms is shown in Figure 3 under four divisions, namely: (1) apples prior to harvest, (2) harvesting apples, (3) grading, packing, and marketing apples, (4) other crops. On Farms 5, 6 and 8, the functions after harvest, except for certain early varieties, were definitely left to other agencies each year. On Farm 3 this plan was followed one season. On Farm 3 in other seasons, and on Farms 2, 7, 9 and 10, a very highly graded product was put up. On the remaining farms more simple grading and packing was practiced. This diversity does not indicate that the practice on some farms was right and on others wrong. The extent to which the farmer should proceed in rendering services beyond the harvesting of apples is an individual problem. The added services of grading, packing, storing, transporting to market and even selling greatly change the total labor requirement and also the seasonal distribution. It is a problem which must be solved by each individual after giving due consideration to the need for constant gainful employment, other crops and alternate possibilities for employment, the variety and quality of apples produced, opportunities for marketing, special abilities of the operator, facilities and equipment on the farm, and possibly other factors.

The annual distribution of labor on apples by ten-day periods for five typical farms is shown in Figures 4 and 5. The peak of labor demand in every case comes at the harvest period. This harvesting peak was in the last week of September in every case except Farm 1.

Although the labor prior to harvest is spread over eight months or even more, the total requirement is generally no greater than that needed for harvesting. (See Fig. 3.) On Farm 8 between three and four times as much labor was required to harvest as to grow the crop. In no case was the harvest labor lower than about 60 per cent of that used prior to harvest. On the average for all farms harvest labor exceeded that used in growing by a very small margin. Depending on varieties the harvest may begin in the last days of August and continue until late October, a maximum period of about two months.

Fortunately, there is usually a good deal of suitable labor available at that date. It is advantageous, nevertheless, to provide fairly steady employment in order to hold the crew together for the season or even to maintain a nucleus of the harvest organization from year to year. Steady employment will tend to hold the services of experienced, skillful, conscientious pickers, and men who can be trusted to handle the fruit with care from tree to packing house.

For greatest efficiency in harvesting, the planting should be divided between a reasonable number of varieties which ripen successively. The leading variety in New Hampshire, the Baldwin, may generally be picked over a period of about two weeks beginning as a rule about October 10. The McIntosh as grown here has a picking season of not to exceed ten days, usually in late September. Farther south the picking period is even

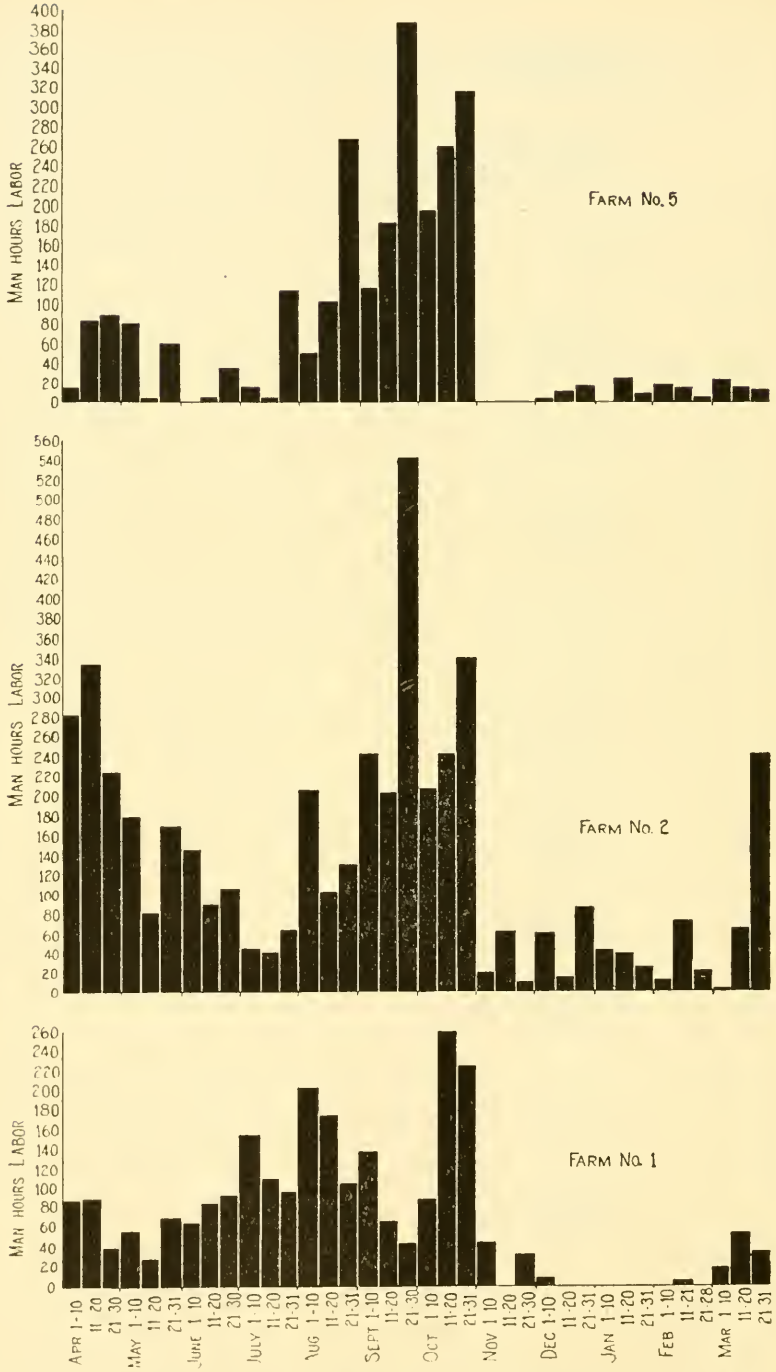

Fig. 4. *A comparison of distribution of labor on apples on three farms. Includes harvesting but not grading and packing.*

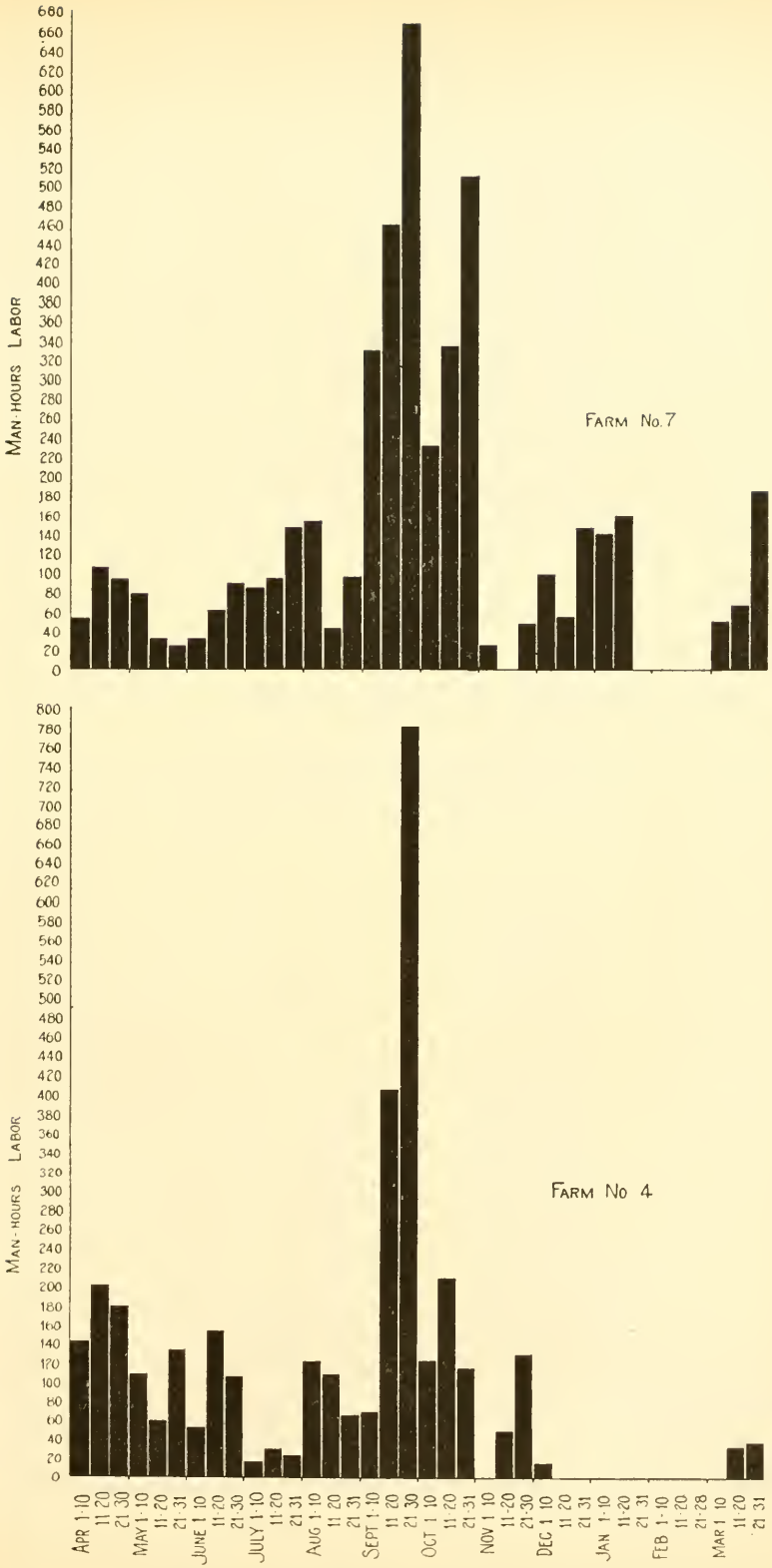

FIG. 5. *A comparison of distribution of labor on apples on two farms. Includes harvesting but not grading and packing.*

shorter and at higher latitudes is somewhat longer. Wealthy and Gravenstein, which are the next most important varieties although planted in considerably smaller numbers, are harvested somewhat before the McIntosh season. In actual practice the varying yields of different varieties make the harvest labor requirement uneven, no matter how well the orchard is planned. This is illustrated in Fig. 6, which shows the harvest labor by ten-day periods for three seasons on the same farm. In 1926 with a good crop of Baldwins and a light crop of McIntosh the distribution was bi-modal with the main peak occurring in October. A heavy drop occurred that season and salvaging of the windfalls continued until late in November. In 1927 with relative yields of these two varieties reversed, the curve is still bi-modal, but with the greater peak in September. In 1928 all varieties yielded well, and the distribution of labor was very satisfactory. The gradual increase in demand for labor that year was easily handled by the operator.

In the case of another farm planted chiefly to Wealthy and Baldwin with very few McIntosh, the distribution of harvest labor cannot be very satisfactory under any circumstances. The daily labor demand for harvesting apples on this farm is shown in Fig. 7, and, as might be expected, there is a period of nearly four weeks when but little picking can be done. If 30 or 40 per cent of the trees were McIntosh, the harvest labor requirement would be much more constant.

A more intimate picture of the relation of varieties to the harvest problem can be had by studying the daily distribution of harvest labor on Farm 2 in 1926. (Fig. 8) Wealthy and Gravenstein competed for harvesting labor from late August until about Sept. 20. Peak harvest of Gravenstein, however, preceded the peak for Wealthy. McIntosh were not ready for three or four days following completion of the Wealthies and Gravensteins. The crop being light a reduced crew completed the picking in about five days. Then practically a whole week intervened before Baldwins were ready. Wagners were picked after the bulk of the best Baldwins, leaving some rather small Baldwins on old trees to the last. In this instance Baldwin harvest extended from October 11 to November 4 inclusive, a period of 25 days. Considerable loss occurred, however, and a large number of drop apples were picked up later.

Greatest efficiency is attained in picking and handling with a uniform labor demand over a long season. The small crew may be limited to the most skilled individuals available. The investment in ladders, picking buckets, and equipment for hauling fruit is kept at the minimum. Yet if one variety is considerably more profitable than others, it may pay to plant more of these trees and incur the extra costs incident to using a large crew for a short season.

From the point of view of harvest management, which is one of the most important in choosing varieties for the commercial orchard, one might proceed by listing in order the varieties that seem to give the greatest opportunity for profit. Then one could plan to have as many trees of Number 1 as he could harvest satisfactorily under his conditions; then as many of Number 2 as could be harvested without conflict with Number 1; then as many of Number 3 as could be picked without conflict with Numbers 1 or 2 up to the maximum planting of each that seems advisable under prevailing market conditions.

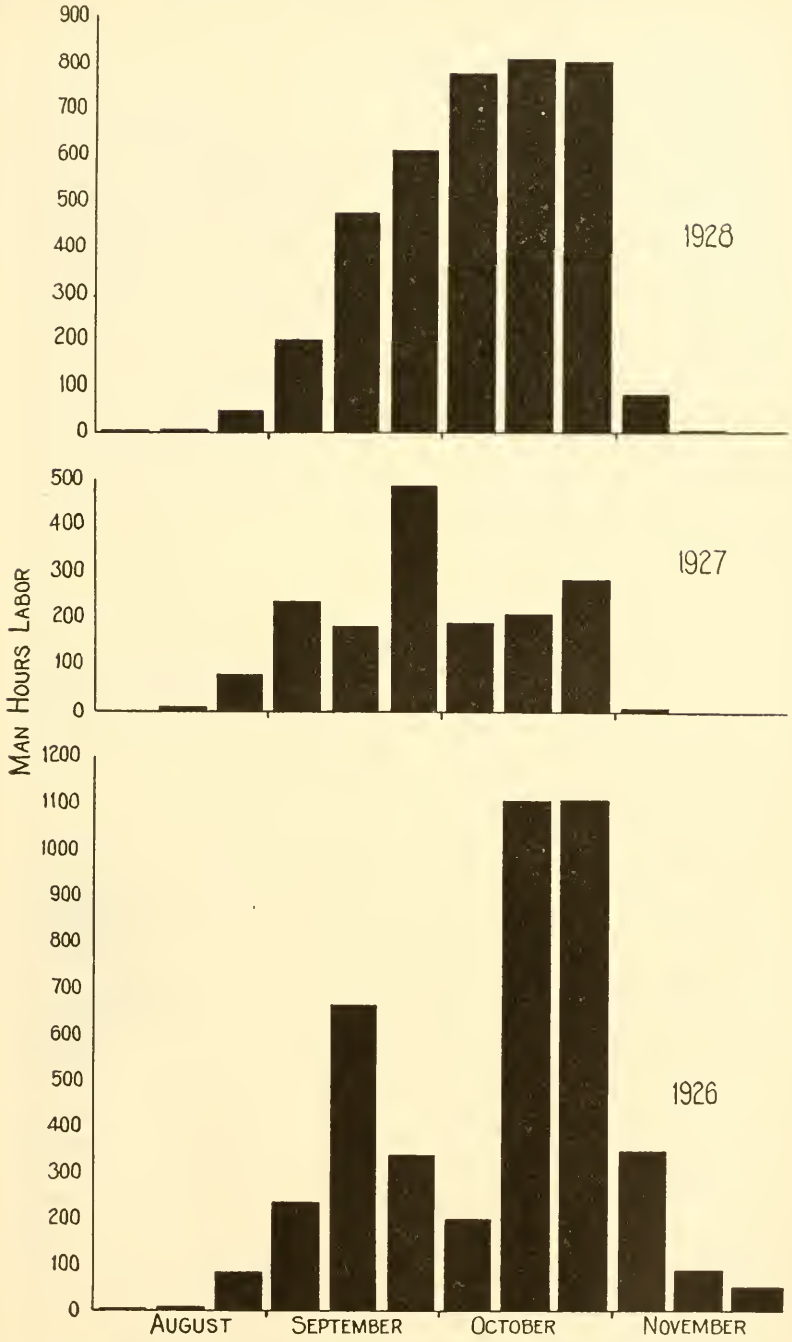

FIG. 6. *Comparison of distribution of labor requirement in harvesting apples on Farm 2 for three successive years by 10-day periods.*

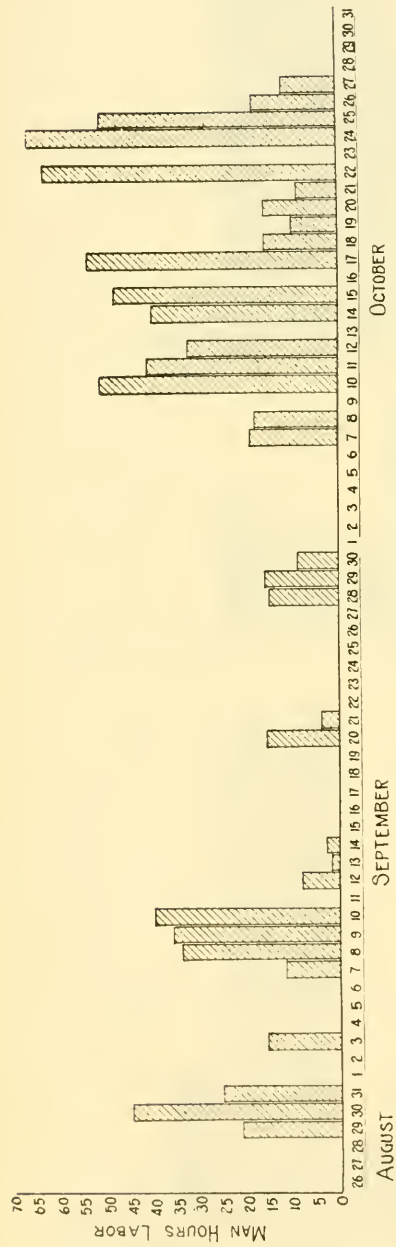

FIG. 7. *Daily distribution of labor in harvesting apples on Farm 1.*

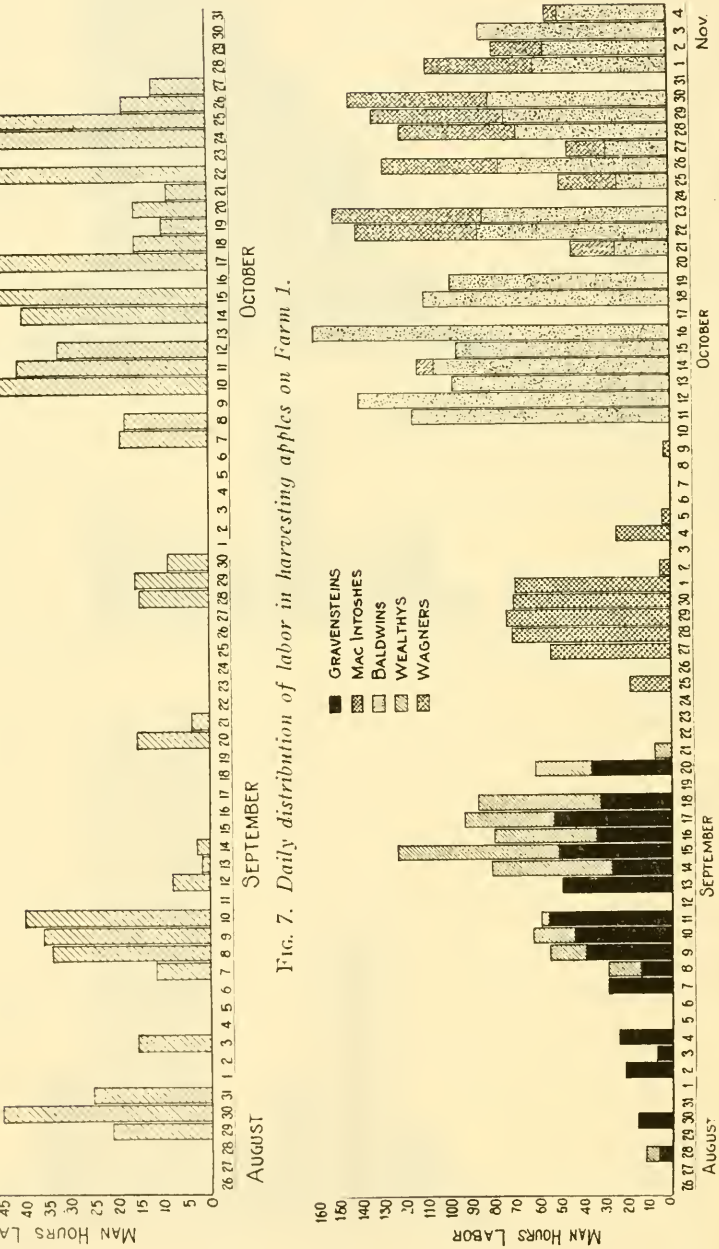

FIG. 8. *Daily distribution of labor in harvesting apples on Farm 2 by varieties.*

One man could not expect to pick more than 50 mature McIntosh trees because out of the ten days that usually comprise the season, some are bound to be Sundays, holidays, or days with unsuitable weather. The same man probably could also pick 50 Gravensteins and nearly 100 Baldwins. Thus, if a man were to plan on 2,000 permanent trees, he might estimate that in an average season using a uniform crew he could harvest 600 McIntosh, 1,000 Baldwin and 400 Gravenstein trees. While this is most advantageous from the harvesting point of view, actually, on account of greater expected returns from the McIntosh variety than from others, he might well plant 1,000 McIntosh, 800 Baldwin, and only 200 Gravenstein. The extra costs of harvesting on account of using more equipment and more men for a short time would be offset by the greater returns from a combination in which McIntosh represented a large proportion of the trees. In fact, it is advantageous not to assemble a large crew at once but to start on a limited planting of early varieties with a nucleus of most experienced workers. Then as volume increases others can be assimilated and trained from time to time. To assemble a large crew suddenly is expensive, and the profitableness of the several sorts should be considered carefully before committing oneself rather permanently to that policy.

Prior to Harvest

In Figure 9 the labor on apples for the season of 1927 on four typical farms is distributed by ten-day periods. This is labor performed by regular crews, in contrast to harvesting, which is done mainly by extra day or short term help. With the harvest omitted, there is little uniformity between farms; this indicates that there is much leeway in performing most of the orchard tasks. On Farm 2 there is a decided peak in the spring beginning about March 20, and a minor peak in August. On Farm 7 the spring peak is not so pronounced as the July and August period, due in considerable measure to thinning. On Farm 1, where there is a large planting of Wealthy apples, the July-August peak is prominent. There are some Wealthy trees on Farms 2 and 7, also. When thinning is not practiced the labor requirement in the mid-summer months is low.

The distribution of labor in pruning and spraying operations, which require special skill, is shown in relation to other orchard work. Farms 2 and 7 present decided peaks of pruning labor, but at different seasons. This operation can be done at any time from December 1 to about the middle of April. The peaks represent a convenient time, rather than actual definite demand.

While the total demand for skilled labor in spraying is not large, it is of great importance because of the very definite and brief periods during which certain sprays must be applied. So exacting are the requirements for skilled labor and expensive equipment that if successful disease and insect control is to be achieved, spraying must at all times be placed first in relation both to other crops and other orchard work. Even if labor is much needed on other crops, the spraying operation should not be neglected.

Even so, there does not seem to be as much similarity between farms in time of spraying as one would expect. The distribution of labor for this operation is shown by the black area in Figure 9. The method of classifying time by 10-day periods might accentuate differences in time

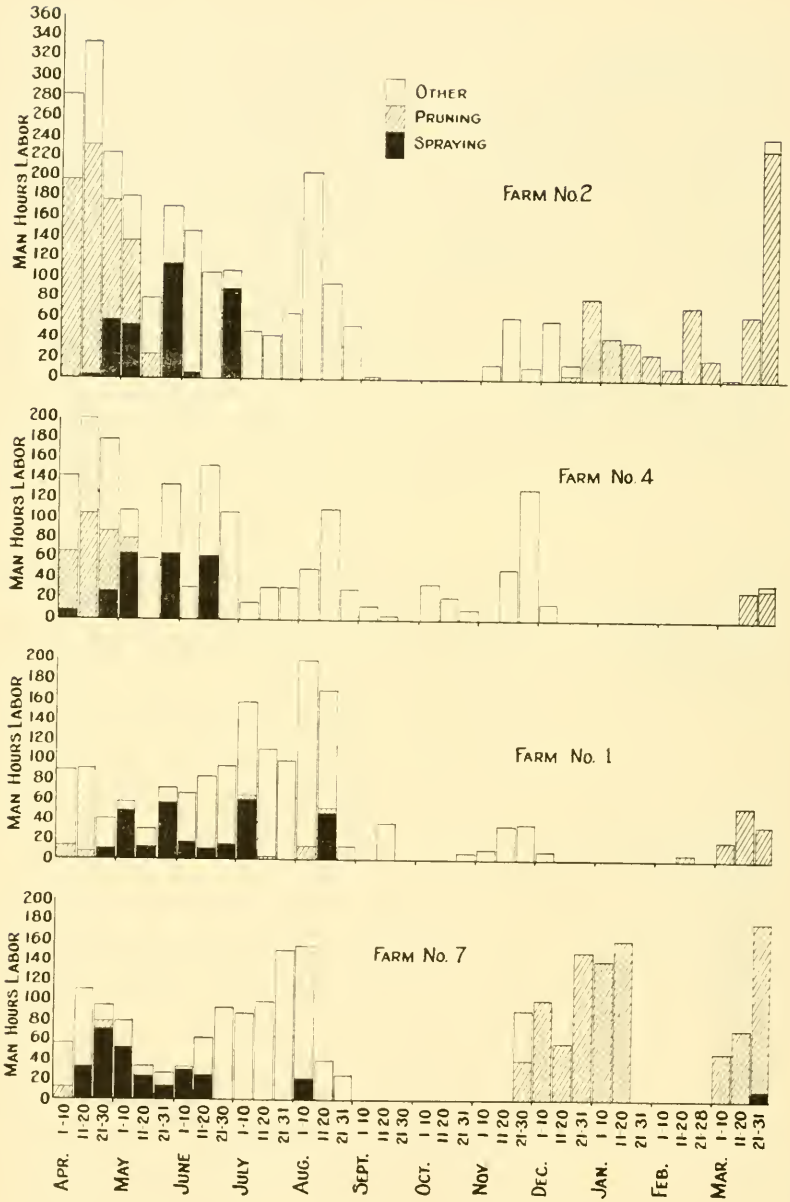

Fig. 9. *Distribution of labor on apples prior to harvest by 10-day periods; also distribution of labor on spraynig, pruning, and other operations.*

of application, yet even when the distribution of labor in spraying is charted by days, there is no uniformity in distribution. It is also true that there is a greater tendency for the sprays to overlap on extensive farms. On Farm 7 dusting was practiced following the bloom period; the applications were made more frequently than if liquid spray had been used, but the time required for each application was much less.

Since orchards in New Hampshire are largely sod mulch, there is no very serious peak of horse labor requirements. As in the case of man labor, the most serious conflict may come at the brief definite spray periods. But since the crew is busy spraying at these times, there is usually no large demand for horses for work other than spraying.

DISTRIBUTION OF TIME ON OTHER ENTERPRISES

Diversification in the case of apple farms has two objectives: first, a diversified source of income as insurance over years unfavorable as to yield and price; and second, continuous employment of permanent labor in productive work.

The need of other sources of income to balance the erratic fluctuations in returns from apple production is obvious. On one farm, the gross returns from apples were $1,063 in 1926, and $6,277 in 1927. Two years of unfavorable yields and low prices bring difficulties and hardship to the average man, and a series of such years is disastrous. Then, too, the seasonal demand for money to carry the apple crop to harvest is often a serious problem on farms producing apples only.

Continuous employment for the operator and perhaps one or more regular men by means of diversification with other crops results in lower cost for the labor on fruit. If regular labor is maintained in order to be available for the requirements of the orchard and is not able to find productive employment when orchard work is slack, then the orchard must pay not only for the time actually spent on it but also for that which was not used. If the regular help can produce other crops advantageously in slack periods, the whole farm enterprise is more profitable.

It is obvious that certain crops or enterprises would supplement and others would seriously compete with apples for the available labor. A study of time distribution on apples and on individual enterprises indicates the relation. In each case, the orchard is considered the major enterprise, and the combination is studied from the viewpoint of how the other enterprises fit into apple growing.

Strawberries:

The chief operations on strawberries are: (1) uncovering old beds, (2) preparing soil and setting new beds, (3) cultivating and hoeing new beds, (4) harvesting berries, and (5) mulching beds. Each of these must receive attention within a certain time range for best results. Uncovering of old beds is a comparatively minor operation. If delayed it tends to retard blossoming and harvest, which is usually desirable. Setting of the new bed should be completed by the first week in May; otherwise the plants may not throw as many runners as is desirable, nor produce as much fruit per runner plant. If the plants are check-rowed when set and the proper equipment is available they may be cross-cultivated and the labor of hoeing and weeding thus kept at a minimum until about July first

when active runner production begins. Late in the season as the number of runners multiplies, the task of hoeing and weeding increases rapidly. In this section the beds are usually allowed to produce for one season only, and many growers do not attempt to keep them perfectly free from weeds as the season advances. The berries are picked by women or children by the quart, but some labor is required for supervision, handling and marketing of the fruit. The peak demands may be made to come in mid-June to August when little work is required on the orchard unless apple thinning is practiced extensively.

The only competing orchard operation that is very definite as to time requirement is spraying. However, the many hours of weather unfavorable for spraying, together with the intervals between sprays, are sufficient for the culture of a limited acreage of strawberries without neglect of either operation. For instance, on Farm 4 the four men including the operator worked on strawberries in this period whenever the weather was too windy or unfavorable for spraying. About two acres of strawberries were made to fit into the orchard program very satisfactorily.

On this farm, as shown in Figure 10, labor on strawberries in May tended to increase as the apple spray program diminished. The peak labor periods on strawberries in the middle of June and the first part of July fitted into slack orchard periods. Most of the harvesting was done by women and children by piece work and is not included in the chart.

On Farm 4, the peak labor requirement on strawberries in May conflicted with the orchard spray program, but in this case the area of strawberries was rather large in relation to number of fruit trees.

On Farm 2, also the work on strawberries was done by the regular hired labor without serious conflict between spraying and hoeing.

On Farm 4, a total of 1,334 hours of man labor, not including picking, 267 hours of horse labor and 88 hours of truck time were used in producing two acres of berries. If one assumes a rate of $.40 per hour for the labor, the $1,600 worth of berries sold cost approximately $1,360, leaving a margin of $240 for management and risk. Or stated in another way, the labor returns on strawberries amounted to approximately $.58 per hour.

But as to whether strawberry growing is a profitable use of the orchardist's time can best be considered from the viewpoint of the additional expenses and additional receipts. For instance on Farm 4, the operator keeps a regular crew sufficient to meet the labor requirements in spraying. If we take for granted that he must keep these men through the growing season in order to have them when needed, the situation in 1926, a good year, was about as follows:

Additional income from sale of berries		$1,600
Additional cash expenses:		
Extra labor harvesting	$300	
Plants (used own plants)		
Trucking (estimated cost)	100	
Fertilizer	100	
Cover mulch	40	
Boxes	80	
Miscellaneous	50	
		670
Additional income		$930

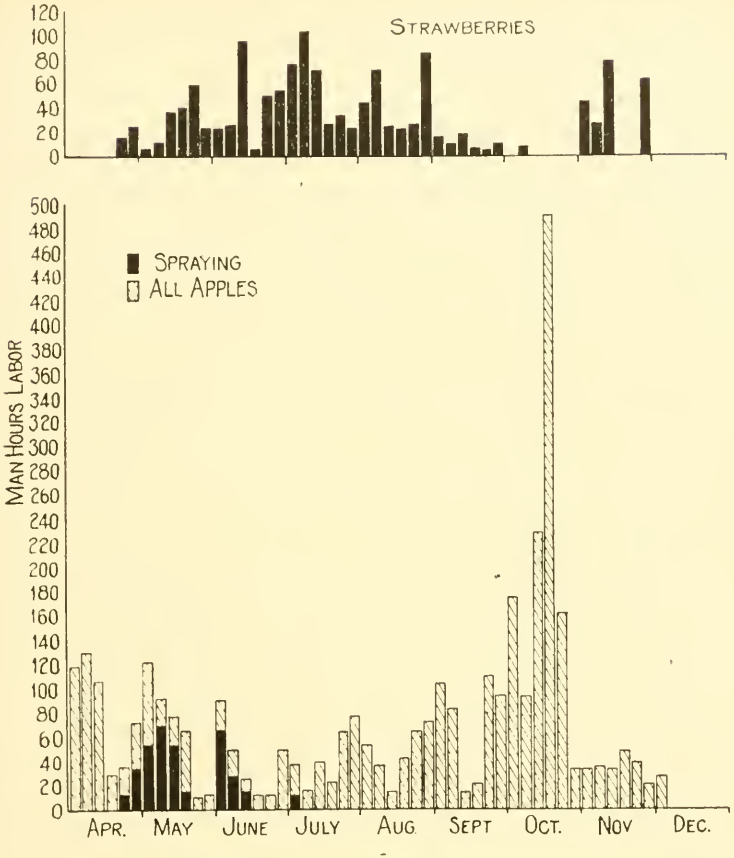

FIG. 10. *Distribution of labor in spraying, all apple work and labor on strawberries (not including labor in picking on Farm 4).*

The farm income was greater by $930 by adding strawberries to the orchard enterprice. Of course, the men had to do more work, and the operator took on a heavier burden, and whether this is worth while depends upon individual circumstances.

The size of strawberry acreage needed to make the best fit will depend on the orchard management as well as on the exact methods employed in strawberry production. Beyond a certain acreage, additional help will be required, and the crop will then be a major enterprise, as indeed was the case on one of the farms in the study, proving a very profitable crop.

In conclusion, it seems that a limited area of strawberries can be made to fit well into the orchard organization, and that where markets are available it is an excellent crop with which to diversify.

Cherries:

On one farm there were about 32 mature cherry trees. These require pruning, spraying and fertilization, much as do the apples. Since apple

thinning was not a problem on this farm, the harvest of cherries in July did not conflict with the orchard work, and the owner and his regular hired help were able to employ to good advantage their time and that of a part of the harvest crew.

The limited number of cherry trees was an asset to this farm organization, as the operator was able to secure a local market. In fact, because of the difficult problem of marketing any considerable quantity of cherries as fresh fruits, this form of diversification probably should be limited to the amount which can be sold locally.

In districts where sour cherries are grown extensively they are usually either canned or frozen; and in the absence of these facilities, cherry growing on an extensive scale is a doubtful enterprise.

Beans:

The operator of one farm produced about two acres of dry beans each year supplementary to the apple industry. Beans were harvested by hand between the Wealthy and Baldwin harvest. On this farm with only a few bearing McIntosh trees, apple picking makes little demand for labor for about two to four weeks. The operator has found it to his advantage to provide profitable employment during this time to hold his pickers for the Baldwin harvest.

If this farm had about 500 McIntosh apple trees, the time between the harvesting of McIntosh and Baldwins would usually be needed to pack and haul the McIntosh to market. In this case the growing of beans would be a doubtful supplementary enterprise, at least as now handled. Perhaps with special bean harvesting equipment the two acres could be put into the barn in a brief time. The other operations on the crop required little labor and did not compete seriously with apples. The vines were stored on the barn floor and were scattered in such a way as to dry and cure there. They were threshed by hand flail and picked over by hand during the winter. Any productive employment for the operator at this season was a decided advantage.

The operator of this farm was successful in getting good yields of high quality beans. The light soil and large barn for curing made a good combination. In 1926 the two acres of beans with a total production of 4,000 pounds would show a satisfactory profit even if labor were charged at $.40 per hour. Since much of the hand work in threshing and picking over was done on stormy days in the winter, the crop was produced at very little out-of-pocket expense.

The situation is roughly shown in the following statements:

Added gross income:		
Sale of 4,000 pounds of beans	$240.00	
Minus 2 tons of hay displaced	20.00	
		$220.00
Additional out-of-pocket expense:		
Fertilizer	$20.00	
Seed (used own seed)		
Extra labor	40.00	
		60.00
Additional net income		$160.00

By growing beans this operator added approximately $160 to his net income. Of course more work is done. The operator may be flailing beans on a winter day instead of reading and visiting.

On another farm about three acres of snap beans were grown between the trees in the young orchard. The work on beans did not seriously compete with orcharding. The seeding, cultivating and hoeing could be done between sprays, and the picking was finished before apple harvest. Even if treated as an independent major crop, the undertaking was profitable except in one bad blight year.

Potatoes:

The operator of one of the farms produced about two acres of potatoes each year. The harvesting of potatoes and apples would seriously conflict on most farms. This operator, however, was able to handle both crops, using the same crew. He usually harvested beans and sweet corn and some of the potatoes between the Wealthy and Baldwin harvest, and then completed the digging of potatoes immediately after the Baldwins were out of the way.

The work of planting, cultivating and spraying potatoes was so fitted into the slack periods of the apple program that no extra help was required.

Based on assumed rates of pay for labor employed on potatoes, the profit was negligible; but since much of the labor was available anyway, the influence of this crop on income can best be shown by observing the additional returns and additional expenses, which, for the 3 years were roughly as follows:

Added gross income from growing potatoes:		
Sale of 400 bushels of potatoes		$400
Additional out-of-pocket costs:		
Seed, 36 bushels @ $1.50	$54	
Fertilizer, 2 tons @ $40	80	
Spray material, $14	14	
Additional labor in harvesting	40	
Rent of planter (estimated)	10	
	——	198
Additional income from growing potatoes		$202

Since little stock was kept, the loss of two acres of hay each year is insignificant; in fact, over a period of years the heavy fertilization for potatoes probably means increased total harvest of hay. For the added net income of $200 a year, the operator, of course, works harder, has less free time; his regular man does more work, and the horses do more work. Whether this is advisable is an individual problem. Potato production would not work out so well on any other farm of this group.

Timber:

On one considerably diversified farm the operator felt that six regular men were necessary to operate the orchard and that it was best to employ them for the entire year. By planning in advance, a timber lot within 2 or 3 miles was cut each year, and the logs and wood were hauled to market.

In Figure 11 the shaded area indicates how well this system used the available labor. In December, January, February and March, roughly

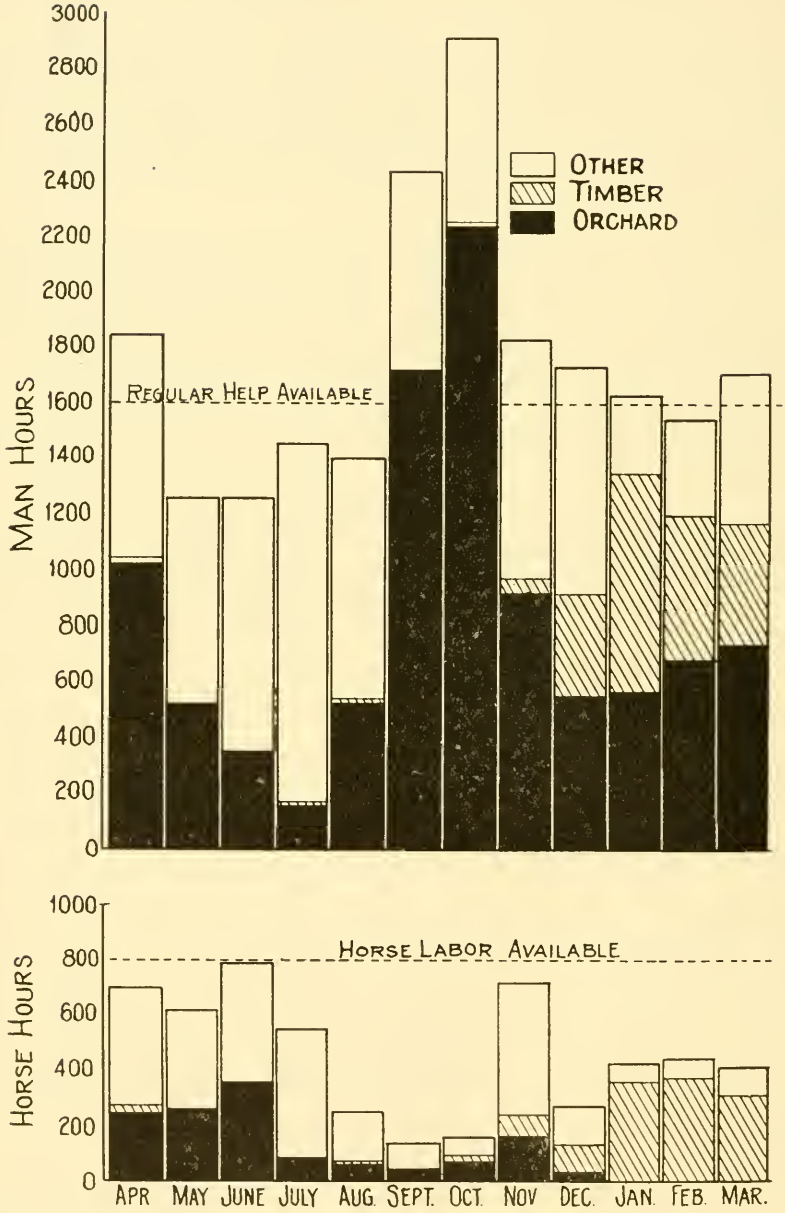

Fig. 11. *Distribution of man and horse labor by months on apples, timber, and other field work.*

one-fourth of the total available time was spent in timber work. The operator planned to work in the woods whenever the weather was not suitable for pruning and still not bad enough to make work in the woods uncomfortable.

Assuming that the regular hired men would be carried through the year anyway—and the operator felt he had considerable responsibility toward the men—the logging operations advantageously made use of the available labor. This was also true of the available horse labor, since there would otherwise have been no work for the teams.

The situation computed on the basis of additional income and additional expenses would be about as follows:

Additional income:		
Sale of lumber and wood		$2,156
Additional expenses:		
Standing timber	$1,000	
Teams (merely extra grain)	50	
Equipment (repairs, etc.)	40	
Cost of extra labor	100	
		1,190
Additional net income		$966

In other words the 2,057 hours of man labor and 1,276 hours of horse labor brought $966 additional gross income. In 1928, the demand for box boards was not promising, and the crew could not be used advantageously in operating the lot.

On two other farms the men and teams were used advantageously for one or more months in winter in hauling logs or ice for other people.

Cows:

On one of the farms a few cows were kept, the number being gradually increased to 12 in the last year; this was about the limit for which hay land and pasture were available. The hay was harvested anyway and did not compete seriously with orchard work. The daily chores of milking, feeding, and cleaning the stables, of course, had to be done each day, but practically all of this was managed before seven o'colck in the morning and after five o'clock at night. The keeping of 12 cows resulted in a longer day for the operator and two of the hired men. It was necessary to have somewhat more regular working hours for the operator and a few of the men at peak spray periods; but since there were six to seven men on this farm, this was not difficult to manage.

The cows did provide profitable employment in the winter, made a market for the available roughage and incidentally provided dressing for application to truck crops.

There is not much question but that dairying is a profitable side line on this farm. The care of cows did not compete seriously with orcharding nor lead to the neglect of any standard practice. On certain farms with abundance of good hay land in addition to the orchard, dairying should be a good supplementary enterprise.

Poultry:

About 300 laying hens were kept by one operator. The poultry work was done before and after the regular day except that odd jobs such as

cleaning houses were managed when orchard work was slack. Neither enterprise was neglected.

This operator had found in previous years that the raising of pullets interfered greatly with early spring orchard work, especially spraying. Consequently, he planned to purchase pullets in the fall. He states that when his main orchard was first set out, the raising of pullets did not cause difficulty and that the poultry enterprise helped to carry the expense of growing the young orchard to the bearing stage. The use of early hatched chicks will lessen the conflict between orchard and poultry. From the experience of this one farm it appears that the keeping of chickens on a limited scale may be made a favorable supplementary enterprise provided the operator is skilled in poultry husbandry.

Most orchardists can conveniently fit one or more supplementary enterprises into the orchard program. Since most of these possible crops must be marketed locally, their inclusion on any particular fruit farm should be after carefully considering the outlets. Many orchard farms are located some distance from markets, and frequently, as was the case on even the most highly diversified farms in this study, have little land well suited for cash crops.

On several of the small farms operated by older men, the slack season in winter was used to good advantage by making trips to visit relatives and by several months of semi-leisure.

In starting a new orchard enterprise, it would be well to consider leaving some good land near buildings for the growing of cash crops.

DISTRIBUTION OF TIME ON MISCELLANEOUS TASKS

Not all the available time is employed directly on income-producing crops or stock. There are many miscellaneous tasks that require attention. Buildings, fences and roads need to be maintained. Old equipment is cared for, new equipment is studied, purchased and assembled. The merits of various seeds, fertilizers and spray material are discussed with visiting salesmen, purchases considered and orders made out. Partridge and deer damage receive attention and educational meetings are attended. In winter, snow may need to be shoveled. In summer, flower gardens may be spaded for the housewife, or lawns mowed. The collection of accounts may require special trips, and the bank must be visited to make deposits, or to arrange for credits. Horses must be cared for. Accounts are kept.

On some of the farms the miscellaneous items could not be secured very accurately. This was especially true in the case of the older men, who were, in fact, on a part-time retirement basis. The time spent "tinkering around" had to be largely ignored. For this reason data on miscellaneous time is reported in Table 7 for only seven farms. On the average, 18 per cent of the total working time on these farms was spent on tasks such as those enumerated above. Farm 2 was lowest with 15 per cent, and Farm 6 was highest with 23 per cent.

Nearly three per cent of the total time reported, or about one-eighth of the miscellaneous time, was spent on household or personal matters. This amounts to about 287 hours per farm annually, and includes work on wood for home use, on making things for the home, on lawns, and on flower beds in so far as they took the men from the farm work. It does

TABLE 7—*Distribution of total man hours to show time devoted to miscellaneous purposes on seven fruit farms, three years*

	FARM NUMBER								ANNUAL AVERAGE PER FARM
	1	2	3	4	5	6	7	TOTAL	
	Man hours	Man hours	Man hours	Man hours	Man hours	Man hours	Man hours	Man hours	
Household and personal	762	1,205	1,565	239	1,033	349	579	5,733	287
Real estate—New	7	3,179	179	818	16	52	1,170	5,421	271
Maintenance	1,102	1,588	1,108	2,148	1,450	469	927	8,791	440
Equipment—New	5	79	117	33	.....	132	87	452	23
Maintenance	212	1,118	537	370	241	300	556	3,336	167
General miscellaneous	1,219	2,230	1,829	130	433	293	766	6,900	345
Horse chores (estimated)	660	1,743	700	400	450	550	756	5,259	263
Total not directly on productive stock or crops	3,967	11,142	6,035	4,138	3,623	2,145	4,841	35,892	1,796
Producing livestock	1,714	4,453	1,885	.....	2,478	1,573	144	12,247	612
Work off the farm	162	1,542	2,239	464	26	176	837	5,445	272
Labor on orchards and crops	15,778	57,541	17,370	16,522	10,556	5,519	23,333	146,620	7,331
Total directly on productive stock and crops	17,654	63,536	21,494	16,986	13,060	7,268	24,314	164,312	8,216
Grand total hours labor reported on farms	21,621	74,678	27,529	21,124	16,683	9,413	29,155	200,204	10,010
Per cent of total labor used for personal enterprises	3.5	1.6	5.7	1.1	6.2	3.7	2.0	2.9	
Per cent of total labor not directly on productive enterprises	18.3	14.9	21.9	19.6	21.7	22.8	16.6	17.9	
Per cent of total labor used directly on productive enterprises	81.6	85.1	78.1	80.4	78.3	77.2	83.4	82.1	

not include tasks done during the noon hour, evenings, or holidays. Farm 3 reported the largest personal item—1,565 hours for three years, or an average of 522 hours per year. Number 4 was lowest with 239 hours, or an average of 79 hours per year. The per cent of time on personal items varied from 1.1 on Farm 4 to 6.2 on Farm 5. The average, nearly three per cent, seems considerable, yet for the most part, this work was done when orchard work was slack. In most instances the time was devoted directly to better living.

Work on real estate required a little over 700 hours per farm annually, approximately 270 hours on new and 440 hours on maintenance of old. This includes cutting brush along the fences, picking and hauling stones from fields, hauling gravel, repairing or building barns or packing sheds.

Approximately 189 hours per farm were used annually in caring for equipment. General management required 345 hours. This item was large on farms employing several men, but on a percentage basis the total miscellaneous time was less.

Work on horses was considered a miscellaneous use of time. The amount was estimated by allocating the daily chores between horses and productive livestock.

The total of all time on miscellaneous items ranged from 1,072 to 3,714 hours per farm annually. On seven farms for the three-year period a total of 35,892 hours was so used, or an average of 1,795 hour annually per farm. While much of this labor is in slack times when field work is not pressing, it constitutes a large overhead that cannot be ignored and should be kept at a minimum.

SIZE OF ORCHARDS

The size of orchard is an important factor in low cost apple production. There is probably no best size for all conditions; but in any given situation, taking into account the abilities of the man and his available capital, there is a size that should give optimum returns. This adjusting of number of trees to the man is very difficult and cannot be done arbitrarily.

In the first place, any given orchard is continually changing in size, by growth or decadence of the trees, or perhaps by removal of fillers. For instance, a man may wish to have 1,000 mature trees, but in nearly all instances he will have to be content with fewer at first. Were he to start on a farm with no mature orchard, his labor requirements would be low at first and would gradually increase until maturity was reached after 30 or 40 years. Subsequently, unless replacements were planned with exceeding care, the orchard would decrease in size. In the early stages the operator generally looks on orcharding as a part time occupation and depends on other enterprises to use the major part of his time.

New methods place in the hands of the operator new opportunities to get the important work done more quickly and to that extent have an important bearing on the size of orchard as an economic unit. As an illustration, one 10-acre orchard was a rather ambitious project when planted 50 years ago. It meant plowing and cultivating the stony tract with oxen each year. The owner anticipated that he would have to harvest the apples largely with his family labor and then haul eight miles to the nearest railroad center over rough and difficult roads.

In contrast with this, the orchardist now need not plow at all, but merely spread fertilizer, mow the grass and mulch around the trees. The containers for his fruit will be trucked to his barn by the box-maker, and trucking firms will take the apples from his yard. He may choose, in fact, to let some other agency grade and pack the apples, thus enabling him to concentrate on the production of apples and therefore handle a larger unit.

It is evidently impossible to adjust an orchard perfectly to a size that is most economical for one man, two men, or three men to operate. Methods change faster than the trees can grow. More often capital and the extent of available land determine the size of orchard than any conscious effort on the part of the owner to provide employment for a certain number of men. The adjustment is obtained generally by a greater or lesser degree of diversification with annual crops, or by varying the intensity of care which the orchard receives.

Equipment costs per unit of production are no doubt lower in the extensive orchard of 100 acres or more. Thus, one may estimate the annual costs for interest, depreciation and repairs and find the total maintenance costs of a 16 HP sprayer to be about $300 per year. This includes a supply tank to keep it filled, and a proportionate share of the costs of maintaining a tractor to haul it. Such an outfit is adequate for an orchard of perhaps 100 acres of mature trees, and on this basis the cost per tree is about $0.12 per year. A somewhat smaller machine, tractor drawn, capable of spraying a maximum of 50 acres within a three to five-day period, would cost perhaps $0.17 per tree per year. These estimates are based on rather arbitrary asssumptions as to the life of a sprayer and the cost of repairs, but beyond doubt they illustrate the trend in costs. On a similar basis, a 4 HP sprayer, horse drawn, and used on the maximum acreage which it can safely spray would cost in the neighborhood of $0.28 per tree per year. Of course, the use of any of these machines on orchards smaller than the maximum they are capable of covering increases the overhead cost per tree materially.

In addition to savings on overhead costs, less labor is needed with the larger spraying machines. However, materials are about the same in all cases, and since these constitute a large item, the total cost per tree or per bushel, including equipment, labor and supplies, is not so different as to preclude orcharding on a moderate scale. The increased costs for the smaller units do not constitute an insurmountable obstacle.

The owner of a large orchard may be able to own equipment such as storage plants, grading machinery, which the smaller orchardist cannot install without incurring undue overhead costs. Cold storage facilities on the farm make it possible to pick and pack the crop with a small crew operating over a long season, with resultant gains in skill and efficiency. Most small farms can afford common storage; this will accomplish much the same result, except that fall varieties like McIntosh cannot be held late in the season. If there is any infestation with railroad worm, getting the fruit quickly into cold storage, which checks development of the pest, is imperative. Frequently, cold storage and packing equipment are owned co-operatively, but usually this takes certain services out of the hands of the grower and does not give him and the members of his family a longer

season of employment on the apple crop. The owners of large orchards often sell to better advantage than small growers. Their trade-marks are known on the markets. Co-operative selling sometimes eliminates this difference. If buying is done independently, the large grower will benefit considerably, but co-operative buying of fertilizer and spray material is very general.

The operation of a large orchard involves capabilities not needed on the small unit. It requires ability to organize the work for a large crew and to handle help efficiently. The man who does not have this capacity will earn more with a small orchard. His risks will be definitely less. The investment necessary to develop a large orchard, or even to operate it for one season, is considerable. Lack of funds may limit the size of the enterprise. While within the district there may be much suitable land for orcharding, in individual cases the necessary site for an extensive planting may be lacking.

If one depends on fruit alone for an income, the minimum unit will be one which in an average year will yield what the operator considers to be a reasonable income, and one which he can handle with convenience. Few men will be content with the income from less than 15 to 20 acres of apples, on the basis of yields obtained in the eastern United States. From this the size will range up to several hundred acres, depending on the ambition, qualifications and resources of the owner.

Three permanent skilled workers with 16 HP spray outfit and day help to drive a supply truck should be able to cover 100 acres of mature orchard. Each of the skilled men would have 800 to 900 trees to prune each year and this would take up all the available time.

As an adjunct to other business the lower limit of size of orchard that may be practical to operate will doubtless hinge largely on spraying equipment. Although a certain advantage is lost by having no other alternative, generally the fruit can be sold at harvest time without grading and packing with expensive equipment.

Few men care to work with hand sprayers. The investment in a small power sprayer is fairly high per tree in an orchard of five or six acres, and in a three-acre orchard of about 75 mature trees the annual overhead per tree for spraying equipment would doubtless be $.75 or more. On the other hand, if the farmer hires no additional help in order to care for these trees beyond that which he would have employed anyway, his time may be discounted considerably. It may still be better to own and operate even the three-acre orchard than not to. Then there is the possibility for the ingenious man to assemble a sprayer very cheaply, using an engine and possibly other parts already on the farm.

A very important consideration with reference to the small orchard is the skill and knowledge needed. Orcharding is a specialized business, and success will be attained only by the man who has the time, inclination and ability to master its problems. There is a general tendency to neglect orchards which are too small to represent a considerable risk or income.